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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/652,991	08/31/2000	Donald L. Yates	MTI-31046	4383

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EXAMINER
TRAN, BINH X

ART UNIT	PAPER NUMBER
1765	8

DATE MAILED: 10/23/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/652,991	Applicant(s) YATES, DONALD L.	
	Examiner Binh X Tran	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 August 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *12,13,20,21,26-28,31-35 and 76-158* is/are pending in the application.

4a) Of the above claim(s) *31-35,76-78,80-110,127-130 and 134-141* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *12,13,20,21,26-28,79,111-126,131-133 and 142-158* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *12,13,20,21,26-28,31-35 and 76-158* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Applicant's election of Species I (claims 12, 13, 20, 21, 26-28, 79, 111-126, 131-133 and new claims 142-158) in Paper No. 8 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). For Species I, applicants further select sub-species hydrofluoric acid for the inorganic fluorine compound and citric acid for the organic acid. These sub-species correspond to claims 20, 26,

2. Claims 31-35, 76-78, 80-110, 127-130, 134-141 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected species, there being no allowable generic or linking claim. Applicant timely elects species 1 in Paper No. 8 in response to the election/restriction requirement.

Claim Rejections - 35 USC § 112

3. Claims 12-13, 79, 125-126, 133 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In lines 4 and 7 of claim 12, "the dielectric layer" lacks antecedent basis. The examiner suggests replacing "the dielectric layer" with --the low-k dielectric layer--.

In line 2 of claim 13, "the dielectric layer" lacks antecedent basis. The examiner suggests replacing "the dielectric layer" with --the low-k dielectric layer--.

In lines 3-4 of claim 79, "the dielectric material" lacks antecedent basis. The examiner suggests replacing "the dielectric material" with --the low-k dielectric material--.

In lines 1-2 of claims 125-126, "the dielectric material" lacks antecedent basis. The examiner suggests replacing "the dielectric material" with --the low-k dielectric material--.

In line 3 of claim 133, "the dielectric material" lacks antecedent basis. The examiner suggests replacing "the dielectric material" with --the low-k dielectric material--.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 12-13, 20-21, 26-28, 79, 111-113, 116-119, 123, 125-126, 131-132, 142-158 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bartlett (US 4,508,591) in view of Yamazaki (US 6,198,133).

Respect to claim 12, Bartlett discloses a method for treating a wafer surface comprising:

providing a wafer surface having a low-k dielectric (silicon dioxide) layer disposed thereon and a photoresist layer overlying the low-k dielectric (col. 2 lines 23-41);

treating the wafer surface to remove at least a portion of the low-k dielectric layer with minimal removal of photoresist layer (i.e. photoresist layer act as a mask) by applying aqueous solution comprise inorganic ammonium fluoride or HF compounds and organic acetic acid (col. 6 lines 27-37).

Bartlett does not explicitly disclose the pH of the aqueous solution. However Bartlett disclose the solution is an acidic buffer solution. Since solution is acidic buffer, the pH of the solution must be less than 7 and greater than 2 (read on pH about 2 to about 6). Bartlett does not disclose the specific removal rate of dielectric layer. However Bartlett teaches that the low-k dielectric is selectively removed. In a semiconductor method, Yamazaki teaches a typical removal rate of silicon oxide (low-k dielectric) at 800-1100 Å using acetic acid and inorganic fluorine-comprising compound.

It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Bartlett in view of Yamazaki by removing the low-k dielectric layer at a rate greater than 1000 angstroms per minute because the high etching rate will reduce the etching time.

Respect to claims 13 and 79, 111-113, 142-149, Bartlett does not explicitly disclose the ratio of HF to organic acid 2:1 (v/v) or about 100:1 to 55:45 and the specific etch rate of the low-k dielectric. However, Bartlett clearly discloses the use of HF and organic acid comprises either acetic acid or citric acid. Bartlett further discloses "the concentration of these chemical primarily affect the etch rate of silicon dioxide" (col. 4 lines 1-5). The examiner interprets that Bartlett clearly teaches that the concentration and etch rate is result effective variables. The result effective variables are commonly

determined by routine experiment. The process of conducting routine optimization experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal concentration ratio and etch rate as an expect result.

Respect to claims 20, 26, 116-118 Bartlett teaches the fluorine-comprising compound is selected from the group consisting of HF and NH_4F (aka ammonium fluoride) and organic acid is selected from the group consisting of acetic, citric, ascorbic (col. 2-3). The limitation of claims 21, 26-27, 119, 146-158 has been discussed in previous paragraphs.

Respect to claims 28, 131-132, Bartlett discloses the solution comprise 1-20 % by volume of ammonium fluoride (read on inorganic fluorine comprising compound) and 10-200 grams of citric acid per liter of aqueous solution. Bartlett and Yamazaki differ from these claims by the specific value of volume percentage and etch rate. However, Bartlett discloses "the concentration of these chemical primarily affect the etch rate of silicon dioxide" (col. 4 lines 1-5). The examiner interprets that Bartlett clearly teaches that the concentration (read on volume percentage) a result effective variable. The result effective variable is commonly determined by routine experiment. The process of conducting routine optimization experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal volume percentage ratio and etch rate as an expect result.

Respect to claim 123, Bartlett does not explicitly disclose the pH of the aqueous solution. However, Bartlett discloses the solution is an acid buffer solution. Since solution is acidic buffer, the pH of the solution must be less than 7 and greater than 2 (read on pH is about 2 to about 5). The limitation of claim 125-126 has been discussed in previous paragraphs.

6. Claims 114-115, 120-122, 124, 133 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bartlett in view of Yamazaki, and further in view of Bell et al. (US 6,309,926).

Respect to claims 115, 120, 124 and 133 Bartlett and Yamazaki fail to disclose the specific selectivity between the photoresist and dielectric layer. However, Bartlett clearly discloses that the etching between the photoresist layer (2) and dielectric has a very high selectivity (greater than 1) with respect to the dielectric layer (See Fig 4-5). Bartlett further shows that the photoresist layer is NOT significantly etch during the wet etching process (Fig 4-5). In a wet etching process, Bell teaches that dielectric : photoresist selectivity is greater than 40:1 and one skill in the art can readily tailor a suitable chemistry to correspond the selectivity (col. 10 lines 11-23). The examiner interprets that Bell teaches that the selectivity is a result effective variables.

It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Bartlett/Yamazaki in view of Bell by having a appropriate selectivity between the dielectric and photoresist layer because high selectivity between dielectric and photoresist layer will require a thinner in thickness of the photoresist layer. Further since the selectivity is the result effective variable (as suggested by Bell), it would have

been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal selectivity as a expected result.

Respect to claim 114, the cited prior art does not explicitly disclose the the organic material etch rate. However, the cited prior art clearly teaches the etch rate of the dielectric layer (Yamazaki) and the selectivity between the dielectric layer and photoresist layer (i.e. organic layer). The etch rate of the organic layer can be calculated base on the etch rate of the dielectric layer and the selectivity. Further both Bartlett and Bell teaches that the etch rate is result effective variable and can be adjust base on the concentration. The result effective variable is commonly determined by routine experiment. The process of conducting routine optimization experiments so as to produce an expected result is obvious to one of ordinary skill in the art.

The limitation of claims 121-122 has been discussed in previous paragraphs.

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X Tran whose telephone number is (703) 308-1867. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Binh X. Tran
October 17, 2002

BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
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